

CLAIMS

1. A high strength steel sheet excellent in formability, chemical converted coating treatment and hot-dip galvanizing, characterized in that: said steel
5 sheet contains, in mass,

0.03 to 0.20% C,
0.005 to 0.3% Si,
1.0 to 3.1% Mn,
0.001 to 0.06% P,
10 0.001 to 0.01% S,
0.0005 to 0.01% N,
0.2 to 1.2% Al, and
not more than 0.5% Mo,
with the balance consisting of Fe and unavoidable
15 impurities; the amounts of Si and Al in mass % and the target strength (TS) of said steel sheet satisfy the following expression (1); and the metallographic structure of said steel sheet contains ferrite and martensite;

20
$$(0.0012 \times [\text{target strength TS}] - 0.29 - [\text{Si}]) / 2.45 < \text{Al} < 1.5 - 3 \times [\text{Si}] \dots \dots (1)$$

where, [target strength TS] is the designed strength of said steel sheet in terms of MPa and [Si] is the amount of Si in terms of mass %.

25 2. A high strength steel sheet according to claim 1, characterized by further containing, in mass, one or more of 0.01 to 0.1% V, 0.01 to 0.1% Ti and 0.005 to 0.05% Nb.

30 3. A high strength steel sheet according to claim 1 or 2, characterized by: further containing 0.0005 to 0.002 mass % B; and satisfying the following expression (2),

$$500 \times [\text{B}] + [\text{Mn}] + 0.2[\text{Al}] < 2.9 \dots \dots (2)$$

35 where, [B] is the amount of B, [Mn] that of Mn, and [Al] that of Al, each in terms of mass %.

4. A high strength steel sheet according to any

one of claims 1 to 3, characterized by further containing, in mass, one or both of 0.0005 to 0.005% Ca and 0.0005 to 0.005% REM.

5. A high strength steel sheet excellent in formability, chemical converted coating treatment and hot-dip galvanizing, characterized in that the ferrite grains, wherein the ratio of the breadth to the length of each ferrite grain is 0.2 or more, account for not less than 50% of the total ferrite grains in said high 10 strength steel sheet according to any one of claims 1 to 4.

6. A high strength steel sheet according to any one of claims 1 to 5, characterized in that said steel sheet is a hot-rolled steel sheet or a cold-rolled steel 15 sheet.

7. A high strength steel sheet according to any one of claims 1 to 6, characterized in that hot-dip galvanizing treatment is applied to said steel sheet.

8. A method for producing a high strength steel sheet according to any one of claims 1 to 7, characterized in that said steel sheet is produced through the processes of: hot rolling at a finishing temperature of the Ar_3 transformation temperature or higher; coiling at 400°C to 550°C ; successively applying ordinary pickling; thereafter primary cold rolling at a reduction ratio of 30 to 70%; then recrystallization annealing in a continuous annealing process; and successively skin-pass rolling.

9. A method for producing a high strength steel sheet according to claim 8, characterized in that, in said annealing process, said steel sheet is: heated to a temperature in the range from the Ac_1 transformation temperature to the Ac_3 transformation temperature + 100°C ; retained for 30 sec. to 30 min.; and thereafter cooled to a temperature range of 600°C or lower at a cooling rate of not less than $x^{\circ}\text{C/sec.}$, x satisfying the 30 following expression (3),

$$x \geq (Ac_3 - 500)/10^a \dots (3)$$

$$a = 0.6[C] + 1.4[Mn] + 3.7[Mo] - 0.87,$$

where, x is a cooling rate in terms of $^{\circ}\text{C/sec.}$, Ac_3 is expressed in terms of $^{\circ}\text{C}$, $[C]$ is the amount of C, $[Mn]$ that of Mn, and $[Mo]$ that of Mo, each in terms of mass %.